

**Subject Matter of the Claims**

**IN THE CLAIMS:**

**Software controlled multi-modal wireless radio communication**

30. A software controlled multi-mode portable handset permitting a user to communicate over multiple wireless networks including at least a first wireless network normally operating within a first frequency band using a first wireless network protocol and a second wireless network normally operating within a second frequency band, different from the first frequency band, using a second wireless network protocol, different from the first wireless network protocol, comprising

a multi-modal circuit including at least one large scale integrated circuit having components suitable to allow access to the first wireless network and to the second wireless network, said multi-modal circuit including:

a memory, including one or more memory devices,

an operating program stored in said memory,

at least a first wireless network protocol software stored in said memory for implementing the first wireless network protocol,

at least a second wireless network protocol software stored in said memory for implementing the second wireless network protocol,

a transceiver including a programmable circuit, responsive to a control signal, to generate a radio frequency signal within either the first frequency band or the second frequency band to cause the transceiver to access either the first wireless network or the second wireless network,

network signal processing circuit for processing signals sent and received over either the first wireless network or the second wireless network using the corresponding first wireless network protocol or the second wireless network protocol, and

a microprocessor connected with said memory and said transceiver; and

a user interface connected with said microprocessor for allowing the user to indicate preferences for network access to cause said microprocessor, under control of said operating program, to generate appropriate control signals including said control signal for the transceiver,

to cause said transceiver to send and receive signals wirelessly over said at least first wireless network or over said second wireless network using either said first wireless network protocol software or said second wireless network protocol software depending on which network is being accessed.

31. A software controlled multi-mode portable handset permitting a user to communicate over multiple wireless networks including at least a first wireless network normally operating within a first frequency band using a first wireless network protocol and a second wireless network normally operating within a second frequency band, different from the first frequency band, using a second wireless network protocol, different from the first wireless network protocol, comprising

- a multi-modal circuit including at least one large scale integrated circuit having components suitable to allow access to the first wireless network and to the second wireless network, said multi-modal circuit including

- a memory, including one or more memory devices,

- an operating program stored in said memory,

- at least a first wireless network protocol software stored in said memory for implementing the first wireless network protocol,

- at least a second wireless network protocol software stored in said memory for implementing the second wireless network protocol,

- a transceiver including a programmable oscillator circuit, responsive to a digital oscillator control signal, to generate a radio frequency signal within either the first frequency band or the second frequency band to cause the transceiver to access either the first wireless network or the second wireless network,

- network signal processing circuit for processing signals sent and received over either the first wireless network or the second wireless network using the corresponding first wireless network protocol or the second wireless network protocol, and

- a microprocessor connected with said memory and said transceiver; and

- a user interface connected with said microprocessor for allowing the user to indicate preferences for network access to cause said microprocessor, under control of said operating program, to generate appropriate control signals including said oscillator control signal for the

transceiver, to cause said transceiver to send and receive signals wirelessly over said at least first wireless network or over said second wireless network using either said first wireless network protocol software or said second wireless network protocol software depending on which network is being accessed.

## Multi-modal device broader than '985 or '453 issued claims

32. A multi-modal device for facilitating wireless communication over any one of a plurality of wireless communication networks operating pursuant to differing transmission protocols and/or over differing radio frequencies, comprising

a frequency agile radio transceiver adapted to operate at a radio frequency appropriate for each of the plurality of wireless communication networks as determined by a frequency control signal,

a digital interface circuit for interconnecting said frequency agile radio transceiver with external devices to allow information to be sent and received over said frequency agile radio transceiver,

protocol agile operating circuit means for operating said frequency agile radio transceiver and said digital interface circuit in accordance with one of the transmission protocols as determined by a protocol control signal, and

adaptive control means for accessing a selected wireless communication network and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequency determined by the frequency control signal and the protocol determined by the protocol control signal.

33. The multi-modal device of claim 32, wherein said adaptive control means selects the wireless communication network based on the least cost.

34. The multi-modal device of claim 32, wherein said adaptive control means selects the wireless communication network based on the quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

35. The multi-modal device as defined in claim 32, wherein said adaptive control means selects the wireless communication network based on the probability of being dropped from the network.

36. The multi-modal device as defined in claim 32, wherein said adaptive control means selects the wireless communication network based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

37. The multi-modal device as defined in claim 32, wherein said adaptive control means selects the wireless communication network based on prior experience with specific wireless communication networks.

38. The multi-modal device as defined in claim 32, wherein said adaptive control means selects the wireless communication network based on the combined determination of two or more of the following:

- the cost of using the wireless communication network,
- the quality of the transmission link connecting said frequency agile transceiver and the selected wireless communication network,
- prior experience with specific wireless communication networks,
- the potential for being dropped by the network, and
- the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

39. The multi-modal device as defined in claim 32, wherein said adaptive control means is adapted to communicate in accordance with an electronic handshake with selected wireless communication networks to determine on a real time basis the cost for desired services and operating characteristics of the corresponding wireless communication network.

40. The multi-modal device as defined in claim 32, further including a modem means

for modulating and/or demodulating a carrier signal with user data.

41. The multi-modal device as defined in claim 40, further including a data processor means for processing digital data sent and/or received over said frequency agile transceiver.

42. The multi-modal device as defined in claim 41, wherein said data processor means causes said protocol agile operating circuit means is adapted to cause said frequency agile transceiver to control telephone call placement and call answering functions over wireless communication networks having such telephone functions.

## Chipset including transceiver, digital interface, protocol agile circuits, adaptive control means

43. A chipset including one or more integrated circuits for use in a multi-modal device for facilitating wireless communication over any one of a plurality of wireless communication networks operating pursuant to differing transmission protocols and/or over differing radio frequencies, comprising

a frequency agile radio transceiver adapted to operate at a radio frequency appropriate for each of the plurality of wireless communication networks as determined by a frequency control signal,

a digital interface circuit for interconnecting said frequency agile radio transceiver with external devices to allow information to be sent and received over said frequency agile radio transceiver,

a protocol agile operating circuit means for operating said frequency agile radio transceiver and said digital interface circuit in accordance with one of the transmission protocols as determined by a protocol control signal,

adaptive control means for accessing a selected wireless communication network and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequency determined by the frequency control signal and the protocol determined by the protocol control signal.

44. A chipset as defined in claim 43, wherein one of said chips includes a data pump.

45. The chipset of claim 44 wherein said frequency agile radio transceiver, said digital interface circuit, said protocol agile operating circuit means, and said adaptive control means are mounted together as a unit which may be functionally engaged and disengaged with a variety of different host devices.

### Chipset including transceiver, digital interface, protocol agile circuits, adaptive control means (slightly narrower)

46. A chipset including one or more integrated circuits for use in a multi-modal device for facilitating wireless communication over any one of a plurality of available wireless communication networks operating pursuant to at least one of differing radio frequency modulation protocols and over differing radio frequencies, comprising:

a frequency agile radio transceiver operating at a radio frequency appropriate for each of the plurality of wireless communication networks as determined by a frequency control signal,

a digital interface circuit for interconnecting said frequency agile radio transceiver with external devices to allow information to be sent and received over said frequency agile radio transceiver,

a protocol agile operating circuit means for operating said frequency agile radio transceiver and said digital interface circuit in accordance with one of the modulation protocols as determined by a protocol control signal,

adaptive control means for accessing a selected wireless communication network and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequency determined by the frequency control signal and the modulation protocol determined by the protocol control signal.

47. A chipset as defined in claim 46, wherein one of said chips includes a data pump.

48. The chipset of claim 46 wherein said frequency agile radio transceiver, said digital interface circuit, said protocol agile operating circuit means, and said adaptive control means are mounted together as a unit which may be functionally engaged and disengaged with a variety of different host devices.

## A method of using a frequency agile radio transceiver

49. A method of using a frequency agile radio transceiver for facilitating wireless communication over any one of a plurality of wireless communication networks operating pursuant to differing transmission protocols and/or over differing radio frequencies, comprising the steps of

operating a frequency agile radio transceiver at a radio frequency appropriate for each of the plurality of wireless communication networks as determined by a frequency control signal,

interconnecting said frequency agile radio transceiver with a device to allow information to be transferred between said device and a remote device over said frequency agile radio transceiver,

operating said frequency agile radio transceiver and said interconnecting device in accordance with one of the transmission protocols as determined by a protocol control signal,

accessing a selected wireless communication network by generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequency determined by the frequency control signal and the protocol determined by the protocol control signal.

50. The method as defined in claim 49, wherein said step of selecting the wireless communication network is based on the least cost.

51. The method as defined in claim 49, wherein said step of selecting the wireless communication network is based on the quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

52. The method of claim 49 wherein said step of selecting the wireless communication network is based on the potential for being dropped by the network.

53. The method of claim 49, wherein said step of selecting the wireless communication network is based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

54. The method of claim 49, wherein said step of selecting the wireless communication network is based on prior experience with specific wireless communication networks.

55. The method of claim 49, wherein said step of selecting the wireless communication network is based on the combined determination of two or more of the following:

- the cost of using the wireless communication network,
- the quality of the transmission link connecting said frequency agile transceiver and the selected wireless communication network,
- prior experience with specific wireless communication networks,
- the potential for being dropped from the network, and
- the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

56. The method of claim 49 further including the step of engaging in an electronic handshake with selected wireless communication networks to determine on a real time basis the cost for desired services and the operating characteristics of the corresponding wireless communication network.

57. The method of claim 49, further including the step of causing said frequency agile transceiver to control telephone call placement and call answering functions over wireless communication networks having such telephone functions.



## Method of using a frequency agile transceiver (slightly narrower)

58. A method of using a frequency agile radio transceiver for facilitating wireless communication over any one of a plurality of wireless communication networks at least some of which may be available and operating at a given time and location using differing radio frequency protocols and over differing radio frequencies, comprising the steps of:

operating a frequency agile radio transceiver at any one frequency of a plurality of radio frequencies appropriate for each of the plurality of wireless communication networks, said one frequency selected in response to a frequency control signal,

interconnecting said frequency agile radio transceiver with a digital signal processing device to allow digital signal information to be transferred between said device and a remote device over said frequency agile radio transceiver,

operating said frequency agile radio transceiver and said interconnected device in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal,

determining which wireless communications networks are available at a given location and time and,

accessing a selected wireless communication network by generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using a frequency and modulation protocol suitable for transmission of said digital signal information over said selected wireless communications network.

59. The method as defined in claim 58, wherein said step of selecting the wireless communication network is based on the least cost.

60. The method as defined in claim 58, wherein said step of selecting the wireless communication network is based on the quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

61. The method of claim 58 wherein said step of selecting the wireless communication network is based on the potential for being dropped by the network.

62. The method of claim 58, wherein said step of selecting the wireless communication network is based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

63. The method of claim 58, wherein said step of selecting the wireless communication network is based on prior experience with specific wireless communication networks.

64. The method of claim 58, wherein said step of selecting the wireless communication network is based on the combined determination of two or more of the following:

- the cost of using the wireless communication network,
- the quality of the transmission link connecting said frequency agile transceiver and the selected wireless communication network,
- prior experience with specific wireless communication networks, the potential for being dropped from the network, and
- the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless network.

65. The method of claim 58 further including the step of engaging in an electronic handshake with selected wireless communication networks to determine on a real time basis the cost for desired services and the operating characteristics of the corresponding wireless communication network.

66. The method of claim 58, further including the step of causing said frequency agile transceiver to control telephone call placement and call answering functions over wireless communication networks having such telephone functions.

## Claims drawn to Global Positioning System With Omni-modal device

67. An omni-modal device having the ability to determine position and having the ability to access a plurality of wireless networks operating on different frequencies and using different modulation protocols when at least one of the networks has at least three transmitter locations transmitting synchronized time signals, said omni-modal device comprising:

- a frequency agile radio transceiver capable of operating at any frequency or frequencies appropriate for each of the plurality of wireless communication networks, said frequency or frequencies selected in response to a frequency control signal;

- an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow synchronized timing signal information to be sent and received over said frequency agile radio transceiver;

- a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal;

- adaptive control circuit for determining which wireless communications networks are available at a given location and time and for accessing a selected wireless communication network by generating the frequency control signal and the protocol control signal for accessing the selected wireless communication network;

- input means for selecting among the available wireless communication networks a network that has at least three transmitter locations transmitting synchronized signals adequate to allow triangulation when desired by generating said frequency control signal and said protocol control signal appropriate for the wireless communication network that has at least three transmitter locations transmitting synchronized signals adequate to allow triangulation;

- a microprocessor means for determining the relative time delay in receiving at least three synchronized timing signals, and for performing triangulation operations to determine the distance of the omni-modal device from each of the at least three transmitter locations; and

means for determining the position of the omni-modal device based on the distances determined by the microprocessor means.

## Multi-modal device for communication via wireless communication network, including landline cordless network

68. A multi-mode portable handset permitting a user to communicate over multiple wireless networks including at least one cellular network normally operating within an assigned cellular frequency band using a cellular network protocol and a cordless landline telephone network normally operating within an assigned cordless landline frequency band, different from the cellular frequency band using a cordless landline network protocol, different from the cellular network protocol, comprising

- a multi-modal circuit including at least one large scale integrated circuit having components suitable to allow access to the cellular network and to the cordless landline telephone network, said multi-modal circuit including

- a memory, including one or more memory devices,

- an operating program,

- at least one cellular network protocol software for implementing the cellular network protocol,

- cordless landline network protocol software or implementing the cordless landline network protocol,

- a transceiver including a programmable circuit, responsive to a control signal, to generate a radio frequency signal within either the cellular frequency band or the cordless landline frequency band to cause the transceiver to access either the cellular network or the cordless landline telephone network,

- network signal processing circuit for processing signals send and received over the cellular network and the cordless landline telephone network, and

- a microprocessor connected with said memory and said transceiver for generating control signals, including said control signal for the transceiver, to cause said transceiver to send and receive signals wirelessly over said at least one cellular network or over said cordless landline

network using either said cellular network protocol software or said cordless landline network protocol software depending on which network is being accessed.

## Multi-modal device for communication via wireless network, including landline cordless network (slightly narrower)

69. A multi-mode portable handset permitting a user to communicate over multiple wireless networks including at least one cellular network normally operating within an assigned cellular frequency band using a cellular network protocol and a cordless landline telephone network normally operating within an assigned cordless landline frequency band, different from the cellular frequency band using a cordless landline network protocol, different from the cellular network protocol, comprising

- a multi-modal circuit including at least one large scale integrated circuit having components suitable to allow access to the cellular network and to the cordless landline telephone network, said multi-modal circuit including

- a memory, including one or more memory devices,

- an operating program,

- at least one cellular network protocol software for implementing the cellular network protocol,

- cordless landline network protocol software or implementing the cordless landline network protocol,

- a transceiver including a programmable oscillator circuit, responsive to a digital oscillator control signal, to generate a radio frequency signal within either the cellular frequency band or the cordless landline frequency band to cause the transceiver to access either the cellular network or the cordless landline telephone network,

- network signal processing circuit for processing signals send and received over the cellular network and the cordless landline telephone network, and

- a microprocessor connected with said memory and said transceiver for generating control signals, including said [oscillator] control signal for the transceiver, to cause said transceiver to send and receive signals wirelessly over said at least one cellular network or over said cordless

landline network using either said cellular network protocol software or said cordless landline network protocol software depending on which network is being accessed.

70. The multi-mode portable handset of claim 69, further including a user interface connected with said microprocessor for allowing the user to indicate preferences for network access to cause said microprocessor, under control of said operating program, to generate appropriate control signals including said oscillator control signal for the transceiver, to cause said transceiver to send and receive signals wirelessly over said at least one cellular network or over said cordless landline network using either said at least one cellular network protocol software or said cordless landline network protocol software depending on which network is being accessed.

## Multi-modal device for communication via wireless network, including landline cordless network (slightly broader)

71. A multi-modal device for facilitating wireless communication over any one of a plurality of wireless communication networks, including at least one cordless landline network, at least some of which may be available and operating at a given time and location using differing radio frequency modulation protocols and over differing radio frequencies, comprising:

- a frequency agile radio transceiver operating at any frequency of a plurality of radio frequencies appropriate for each of the plurality of wireless communication networks, said frequency selected in response to a frequency control signal;

- an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow signal information to be sent and received over said frequency agile radio transceiver;

- a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal;

- adaptive control circuit for determining which wireless communications networks are available at a given location and time, for accessing a selected wireless communication network,

for communicating with said selected wireless communication network to determine on a real time basis the operating characteristics of the wireless communication network, and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequencies and modulation protocol suitable for transmission of said signal information over said selected wireless communications network; and

input means for receiving said user defined criteria, said user defined criteria comprising at least one of the cost of using the wireless communication network, the quality of the wireless communication network, the potential for being dropped by the wireless communication network, and the security of the wireless communication network;

wherein said adaptive control means operates to generate said frequency control signal and said modulation protocol control signal by comparing said operating characteristics with said user defined criteria.

72. The multi-modal device of claim 71, wherein said adaptive control selects the wireless communication network based on the least cost.

73. The multi-modal device of claim 71, wherein said adaptive control control circuit selects the wireless communication network based on the quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

74. The multi-modal device as defined in claim 71, wherein said adaptive circuit means selects the wireless communication network based on the probability of being dropped from the network.

75. The multi-modal device as defined in claim 71, wherein said adaptive control means selects the wireless communication network based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

76. The multi-modal device as defined in claim 71, wherein said adaptive control circuit selects the wireless communication network based on prior experience with specific wireless communication networks.

77. The multi-modal device as defined in claim 71, wherein said adaptive control circuit selects the wireless communication network based on the combined determination of two or more of the following:

- the cost of using the wireless communication network;
- the quality of the transmission link connecting said frequency agile transceiver and the selected wireless communication network;
- prior experience with specific wireless communication networks;
- the potential for being dropped by the network; and
- the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

## Multi-modal device capable of automatically selecting wireless communication network from a prioritized list of networks

78. A multi-modal device for facilitating wireless communication over any one of a plurality of wireless communication networks at least some of which may be available and operating at a given time and location using differing radio frequency modulation protocols and over differing radio frequencies, comprising:

- a frequency agile radio transceiver operating at any frequency of a plurality of radio frequencies appropriate for each of the plurality of wireless communication networks, said frequency selected in response to a frequency control signal;

- an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow signal information to be sent and received over said frequency agile radio transceiver;

- a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of



modulation protocols, said one modulation protocol selected in response to a protocol control signal;

adaptive control circuit for determining which wireless communications networks are available at a given location and time, for accessing a selected wireless communication network, for communicating with said selected wireless communication network to determine on a real time basis the operating characteristics of the wireless communication network, and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequencies and modulation protocol suitable for transmission of said signal information over said selected wireless communications network; and

input means for receiving said user defined criteria, said user defined criteria comprising at least one of the cost of using the wireless communication network, the quality of the wireless communication network, the potential for being dropped by the wireless communication network, and the security of the wireless communication network;

memory means for storage of the user defined criteria in the form of prioritized set of user defined criteria;

wherein said adaptive control means operates to generate said frequency control signal and said modulation protocol control signal by automatically selecting, from the available wireless networks, the available network which satisfies the prioritized set of user criteria.

79. The multi-modal device of claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon the least cost of using the wireless communication network, and said adaptive control automatically selects from the prioritized set an available wireless communication network based on the least cost of using the wireless communication network.

80. The multi-modal device of claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon the quality of the radio transmission link between said frequency agile transceiver and the available wireless communication networks, and said adaptive control circuit automatically selects from the prioritized set an available

wireless communication network based on the highest quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

81. The multi-modal device as defined in claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon probability of being dropped from the available networks, and said adaptive circuit means automatically selects from the prioritized set an available wireless communication network based on the probability of being dropped from the network.

82. The multi-modal device as defined in claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon the security of the radio transmission link connecting said frequency agile transceiver and the available wireless communication networks, and said adaptive control means automatically selects from the prioritized set an available wireless communication network based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

83. The multi-modal device as defined in claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon the user's prior experience with the wireless communication networks, and said adaptive control circuit automatically selects an available wireless communication network based on the user's prior experience with the available wireless communication networks.

84. The multi-modal device as defined in claim 78, wherein said memory means stores the prioritized set of user defined criteria based upon the combined determination of two or more of the following:

- the cost of using the available wireless communication networks;
- the quality of the transmission link connecting said frequency agile transceiver and the available wireless communication networks;
- prior experience with specific wireless communication networks;
- the potential for being dropped by the networks; and

the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication networks, wherein said adaptive control circuit automatically selects an available wireless communication network based on the combined determination of two or more of the stored criteria.

## Vending device including a multi-modal device

85. A vending device comprising a storage means for one or more types of items to be dispensed, a means for periodically determining the amount of each type of item remaining in the vending device, and a multi-modal device for facilitating wireless communication over any one of a plurality of wireless communication networks at least some of which may be available and operating at a given time and location using differing radio frequency modulation protocols and over differing radio frequencies, said multi-modal device comprising:

- a frequency agile radio transceiver operating at any frequency of a plurality of radio frequencies appropriate for each of the plurality of wireless communication networks, said frequency selected in response to a frequency control signal;

- an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow signal information to be sent and received over said frequency agile radio transceiver;

- a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal;

- adaptive control circuit for determining which wireless communications networks are available at a given location and time, for accessing a selected wireless communication network, for communicating with said selected wireless communication network to determine on a real time basis the operating characteristics of the wireless communication network, and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequencies and modulation protocol suitable for transmission of said signal information over said selected wireless communications network; and

input means for receiving said user defined criteria, said user defined criteria comprising at least one of the cost of using the wireless communication network, the quality of the wireless communication network, the potential for being dropped by the wireless communication network, and the security of the wireless communication network;

wherein said adaptive control means operates at periodic intervals to generate said frequency control signal and said modulation protocol control signal by comparing said operating characteristics with said user defined criteria such that after communication is established the amount of each type of item remaining vending machine is transmitted.

86. The vending device of claim 85, wherein said adaptive control selects the wireless communication network based on the least cost.

87. The vending device of claim 85, wherein said adaptive control control circuit selects the wireless communication network based on the quality of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

88. The vending device as defined in claim 85, wherein said adaptive circuit means selects the wireless communication network based on the probability of being dropped from the network.

89. The vending device as defined in claim 85, wherein said adaptive control means selects the wireless communication network based on the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

90. The vending device as defined in claim 85, wherein said adaptive control circuit selects the wireless communication network based on prior experience with specific wireless communication networks.

91. The vending device as defined in claim 85, wherein said adaptive control circuit selects the wireless communication network based on the combined determination of two or more of the following:

the cost of using the wireless communication network;

the quality of the transmission link connecting said frequency agile transceiver and the selected wireless communication network;

prior experience with specific wireless communication networks;

the potential for being dropped by the network; and

the security of the radio transmission link connecting said frequency agile transceiver and the selected wireless communication network.

## Radio Frequency Management System for dynamic provider information transmission, same as Figure 10 in USP '985 (slightly narrower than claim 23 of US 5,761,621)

92. A radio frequency management system for providing information useful in selecting among a plurality of wireless communication networks having different and variable operating characteristics and accessed by a plurality of portable radio devices each of which is capable of accessing any of the plurality of wireless communication networks comprising:

wireless communication network monitoring means for monitoring the current network load of each of the plurality of wireless communication networks;

processing means connected with said network monitoring means for receiving a signal indicative of said current network load and for generating a signal representing current operational characteristics of the wireless communication network in response thereto;

wireless communication network information transmission means connected with said processing means for receiving said signal and for transmitting over a command channel said operational characteristics for the wireless communication network to each of the plurality of portable radio devices thereby allowing each of the portable wireless devices to selectively access the wireless communication network in response to said operation characteristics; and

means within each portable radio device to selectively access a wireless communication network in response to said operation characteristics.

93. The system of claim 92 wherein said operational characteristics include the cost for use of the wireless communications network.

94. The system of claim 92 wherein said operational characteristics includes one or more of the following:

- the cost of using the wireless communication network;
- the quality of the transmission link connecting said portable radio device and the selected wireless communication network;
- prior experience with specific wireless communication networks;
- the potential for being dropped by the wireless communication network; and
- the security of the radio transmission link connecting said portable radio device and the selected wireless communication network.

A wireless communication network – service provider transmission of dynamic pricing information of Figure 11.

95. A wireless communication network for providing dynamic pricing information, useful in selecting among a plurality of wireless communication networks each operating over a predetermined frequency range subdivided in frequency into frequency bands in which a portion of each frequency band is assigned as a command channel and each having different and variable operating characteristics, to a plurality of portable wireless radio devices each of which is capable of selecting any of the plurality of wireless communication networks according to user specified criteria which includes at least the cost for use of the wireless communication network comprising:

- a wireless communication network monitoring means for monitoring the current network load of the wireless communication network and creating a signal indicative of the current network load;

- dynamic network evaluation means capable of receiving the signal indicative of the current network load from said monitoring means, performing an evaluation of the current network pricing for the cost of use versus the current network load, determining a new network pricing for the cost of use, and subsequently creating a signal indicative of said new network pricing;

network information transmission means connected with said dynamic network evaluation means for receiving said signal indicative of said new network pricing and for transmitting over the command channel said new network pricing of the wireless communication network to each of the plurality of portable wireless radio devices thereby allowing each of the portable wireless radio devices to selectively access the wireless communications network in response to said new network pricing for the cost of use.

96. A wireless communication network as set forth in claim 95, wherein the new network pricing is determined to maximize revenue to the wireless communication network

## Radio Frequency Management System for providing automated price quote information of Figure 10.

97. A radio frequency management system for automated price negotiation between a plurality of wireless communication networks having different and variable operating characteristics and a portable radio device capable of accessing any of the plurality of wireless communication networks according to user defined criteria which includes at least the cost of call transmission over a wireless communication network comprising,

a portable radio device containing means to generate a signal indicative of the type and amount of call information to be transmitted from the portable radio device and means for transmitting the signal to the plurality of wireless communication networks,

the wireless communication networks comprising means for receiving the signal indicative of the type and amount of call information to be transmitted from the portable radio device, and means for generating a signal indicative of a quoted price for said type and amount of call information to be transmitted, and

processing means, within the portable radio device, capable of receiving the signal indicative of a quoted price from each of the wireless communication networks and selecting the wireless communication network which satisfies the user defined criteria.

98. A radio frequency management system according to claim 97, wherein said user defined criteria is the cost for call transmission over the wireless communications network and the selection of a wireless communication network is by the lowest cost of call transmission.

99. A radio frequency management system according to claim 97, wherein said user defined criteria further includes one or more of the following:

the quality of the transmission link connecting said portable radio device and the selected wireless communication network;

prior experience with specific wireless communication networks;

the potential for being dropped by the wireless communication network; and

the security of the radio transmission link connecting said portable radio device and the selected wireless communication network.

## Personal Communication Device for data/voice transmission.

100. A personal communication device for facilitating wireless voice or data communication over any one of a plurality of wireless communication networks at least some of which may be available and operating at a given time and location using differing radio frequency modulation protocols and over differing radio frequencies, comprising

a personal communicator computing means including data input means for inputting user data, display means, a processing means, and memory storage means, wherein the personal communicator computing means is capable of storing frequency and modulation protocol information for each of the wireless communication networks, storing data to be transmitted, generating call placement instructions for use by a multi-modal device;

a multi-modal device comprising

a frequency agile radio transceiver capable of operating at any frequency or frequencies appropriate for each of the plurality of wireless communication networks, said frequency or frequencies selected in response to a frequency control signal;

an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow signal information to be sent and received over said frequency agile radio transceiver;



a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal;

adaptive control circuit for determining which wireless communications networks are available at a given location and time, for accessing a selected wireless communication network, and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequencies and modulation protocol suitable for transmission of said signal information over said selected wireless communication network; and

input means for receiving and storing the user defined criteria for selecting among the plurality of wireless communication networks and for allowing subsequent changes by the user of the stored user defined criteria whenever desired by the user, said user defined criteria defining which one of the wireless communication networks is accessed among the wireless communication networks that are determined by said adaptive control circuit to be available;

wherein said adaptive control circuit operates to generate said frequency control signal and said protocol control signal appropriate for the wireless communication network that is determined by said adaptive control means to be available and satisfies said user defined criteria.

101. A personal communication device as set forth in claim 100, further comprising a connection means for connecting the personal communication device to a telephone landline connector to enable data transmission over a landline.

## Multi-modal Removable (modem) Card.

102. A multi-modal, removable card device capable of being removably interconnected with a computing device for facilitating wireless communication over any one of a plurality of wireless communication networks at least some of which may be available and operating at a

given time and location using differing radio frequency modulation protocols and over differing radio frequencies, comprising

connection means for establishing connection with a computing device;

a frequency agile radio transceiver capable of operating at any frequency or frequencies appropriate for each of the plurality of wireless communication networks, said frequency or frequencies selected in response to a frequency control signal;

an interface circuit for interconnecting said frequency agile radio transceiver with an external signal circuit to allow signal information to be sent and received over said frequency agile radio transceiver;

a protocol agile operating circuit for operating said frequency agile radio transceiver and said interface circuit in accordance with any one modulation protocol of a plurality of modulation protocols, said one modulation protocol selected in response to a protocol control signal;

adaptive control circuit for determining which wireless communications networks are available at a given location and time, for accessing a selected wireless communication network, and for generating the frequency control signal and the protocol control signal in response to a user defined criteria to cause the device to communicate with the selected wireless communication network using the frequencies and modulation protocol suitable for transmission of said signal information over said selected wireless communication network; and

input means for receiving and storing the user defined criteria for selecting among the plurality of wireless communication networks and for allowing subsequent changes by the user of the stored user defined criteria whenever desired by the user, said user defined criteria defining which one of the wireless communication networks is accessed among the wireless communication networks that are determined by said adaptive control circuit to be available;

wherein said adaptive control circuit operates to generate said frequency control signal and said protocol control signal appropriate for the wireless communication network that is determined by said adaptive control means to be available and satisfies said user defined criteria.

103. A multi-modal, removable card device as set forth in claim 102, further comprising another connection means for connecting the personal communication device to a telephone landline connector to enable communication over a landline.

104. A multi-modal, removable card device as set forth in claim 102, further including a modem means for modulating and/or demodulating a carrier signal with user data.

105. A multi-modal, removable card device as set forth in claim 102, further including a data processor means for processing digital data sent and/or received over said frequency agile transceiver.

106. A multi-modal, removable card device as set forth in claim 102, wherein said protocol agile operating circuit means is adapted to cause said frequency agile transceiver to control telephone call placement and call answering functions over wireless communication networks having such telephone functions.